

Partector 2 error messages and limit values

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This document is related to partector firmware version 419. Older (and future!) firmware versions may differ slightly.

This document explains the different error messages the P2 may produce, and what limit values will trigger the corresponding errors.

Errors

The P2 currently can produce 28 different error messages.

Error bit	Decimal Value	Error name	Error limits / reason
0	1	Idiff low	Idiff is $> 0.1\text{nA}$ when it should be 0nA
1	2	Idiff high	Idiff is at least 0.1nA below setpoint (typ. 2nA)
2	4	RH high	RH is $> 80\%$
3	8	Offset high	Offset of EM1 or EM2 is high (limit $\sim 10\text{mV}$, with additional tolerance for temperature and high aerosol concentration)
4	16	Ucor low	Corona voltage $< 2000\text{V}$
5	32	Buffer overflow	Internal FIFO buffer overflow indicating slow firmware execution for some reason
6	64	Generic	Error for anything not covered by the other 15 error bits; currently only used for "SD card missing"
7	128	Deposition voltage low	Deposition voltage too low (more than 5% of target value + 10 V absolute too low).
8	256	EM overflow	EM1 or EM2 reached maximal value (2048mV)
9	512	Selftest error	An error in the selftest at startup occurred. This bit is set if... CE voltage $< -24.26\text{ V}$ or $> -22.26\text{V}$ U+ of EM $< 2.4\text{ V}$ or $> 2.6\text{V}$ U- of EM $< -2.6\text{V}$ or $> -2.4\text{V}$
10	1024	Flow error	Flow more than 0.05lpm off setpoint (too high or too low)
11	2048	Gain 1	EM1 gain more than 10% away from stored value from production testing
12	4096	Gain 2	EM2 gain more than 10% away from stored value from production testing
13	8192	Pump current error	Pump current $< 1\text{mA}$ or $> 50\text{mA}$
14	16384	dP sensor error	dP sensor is not responding
15	32768	Calibration error	Calibration values in EEPROM appear wrong to P2 firmware
16	65536	Idiff unstable	Idiff is unstable in on state (control loop not working properly)
17	131072	Flow possibly wrong	Internal signal analysis indicates that the flow may be wrong (check flow with flowmeter)

18	262144	Idiff average	Idiff average value is more than 0.1 nA away from nominal value (1.0nA)
19	524288	Device dutycycle, device is off	Certain firmware versions offer a “device dutycycle”, where the device runs for 1 minute, then pauses for N minutes. During the pause, data is recorded but flagged with this error bit as invalid.
20	1048576	Bluetooth fail	Communication with Bluetooth module failed
21	2097152	Pressure sensor fail	Absolute pressure sensor failed. Device will assume 980 mbar ambient pressure if this happens. A command can be sent to use a different assumed pressure.
22	4194304	Pulse delay off warn	Diffusion current pulse takes longer than 12cs to drop below 10% of setpoint value
23	8388608	Pulse delay off error	Diffusion current pulse takes longer than 25cs to drop below 10% of setpoint value
24	16777216	Pulse delay on warn	Diffusion current pulse takes longer than 12cs to reach more than 90% of setpoint value
25	33554432	Pulse delay on error	Diffusion current pulse takes longer than 25cs to reach more than 90% of setpoint value
26	67108864	Idiff standard deviation	Standard deviation of diffusion current during pulse (10...100cs) is higher than 0.05nA
27	134217728	Idiff max	Idiff maximum is more than 20% higher than Idiff setpoint
28	268435456	T or flow shutdown	High voltage shut down due to either too high temperature (>50°C) or missing flow.
29	536870912	RH shutdown	High voltage and pump shut down due to too high relative humidity in device (>90%RH)

Decoding example:

The errors are coded bitwise.

This means, if you have the “Idiff unstable” error you get the error code 65536.

Bitwise this means:

1000000000000000

So bit 16 is enabled = $1 \cdot 2^{16} = 65536$

Now if you have not only the “Idiff unstable” error but also the “EM overflow”, this means that beside bit 16 that gets enabled, also Bit 8 gets enabled.

This results in:

1000000010000000

Decimal this is equal to $65792 = 65536 + 2^8$

Another example:

If you have your error code 65538 this is $65536 + 2 = 2^{16} + 2^1$ so bit 16 and bit 1 are enabled so you have simultaneously an “Idiff unstable” error and an “Idiff high” error.

This is how one should apply the decoding table.

9216 => “flow error” + “pump current error”